

# SUSTAINABLE BIOECONOMY

FOR ARID REGIONS

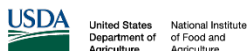


## Guayule as an Alternative Crop

### OVERVIEW

This video lesson introduces students to guayule (*Parthenium argentatum*) with a seminar by Dr. Laura Rodriquez-Urbe. Guayule is a drought tolerant shrub that is a source of natural rubber. Students will learn about guayule and the many products derived from it including latex, resins, and bagasse. Students will learn about research being conducted on guayule.

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## Guayule as an Alternative Crop

### STUDENT LEARNING OBJECTIVES:

After completing this activity, the students will:

1. Understand how guayule can produce many different products.
2. Understand how different parts of a plant are important.
3. Be able to list some of the products that come from guayule.

### TIME REQUIRED:

45 minutes

10 minutes teacher preparation

### RESOURCES:

1. Guayule as an Alternative Crop Lesson Plan
2. Guayule as an Alternative Crop video by Dr. Laura Rodriguez-Uribe (available in English, Spanish, and both languages): <https://www.youtube.com/watch?v=ad6Sbz36ChYv>

### EQUIPMENT AND SUPPLIES NEEDED:

1. Device with access to YouTube videos <https://www.youtube.com/watch?v=ad6Sbz36ChYv>
2. Guayule Quiz (page 3) for all students

### THIS LESSON WOULD WORK WELL AS PART OF:

- Environmental Science curriculum
- Sustainability curriculum
- Agriculture curriculum
- Bioeconomy curriculum

THIS LESSON IS ALIGNED TO AFNR, FFA AND NGSS STANDARDS. Expanded standards listed on page 7.



## ACTIVITY PLAN:

### 1. Bell Ringer (5 minutes):

Have students work in pairs or small groups. Discuss the following questions:

**-What is an alternative crop?** *A crop not usually grown in a geographic area but selected for use due to potential high sale value (products) or specialized benefit to the farming system.*

**-Why do we need to learn about alternative crops?** *These crops help contribute to diversity in agricultural production, can address water challenges, can improve soil.*

**-Why would the United States want to grow natural rubber in the US instead of importing it from other countries?** *The US is the 3<sup>rd</sup> largest importer of rubber in the world due to the large rubber dependent manufacturing industry. The tropical rubber tree (*Hevea brasiliensis*) is under the threat of climate change and disease. Importing can be expensive and is often not environmentally sustainable, sometimes there are transportation challenges, sometimes the crop has other benefits that have not been considered.*

### 2. Guayule as an Alternative Crop Video (15 minutes):

Students will watch the video “Guayule as an Alternative Crop” presented by Dr. Laura Rodriguez-Uribe. The video is 13 minutes long but consider pausing the video to check for comprehension.

### 3. Guayule Discussion (5 minutes):

Have students continue to work in pairs or small groups. Have students discuss and share responses to the following prompts:

-What are two things you learned about guayule that surprised you.

-Discuss 3 guayule products are most interesting to you and explain why.

-Discuss which of the 3 research areas (video 10:12) you want to learn more about: vacuum distillation, mass spectral characterization, guayule metabolic biomarkers).

### 4. Guayule Quiz (10 minutes):

Have students complete the Guayule Quiz (page 3). Have students correct their own quiz using the answer key on page 6. Check for comprehension using the video timestamps on the answer key.

### 5. Leveling Up (5 minutes):

Have each pair or group list ways a crop like guayule could help with water challenges in arid regions.

### 6. Exit Ticket (5 minutes):

Have students continue to work in pairs to groups. Have them list 3 ways guayule is a sustainable crop. Share the list with the entire class and discuss the concept of sustainability and what it means in an arid region.



## DEFINITIONS:

**Alternative crops:** a crop not usually grown in a geographic area but selected for use due to potential high sale value (products) or specialized benefit to the farming system

**Arid Region:** A region is arid when it is characterized by a severe lack of available water, to the extent of hindering or preventing the growth and development of plant and animal

**Bagasse:** is plant residue (as of sugarcane or grapes) left after a product (such as juice) has been extracted.

**Drought Tolerant:** refers to the degree to which a plant is adapted to arid or drought conditions.

**Natural Rubber:** an elastic material obtained from the latex sap of trees (especially trees of the genera Hevea and Ficus) that can be vulcanized and finished into a variety of products.

**Parthenium argentatum:** The botanical name for guayule.

**Sustainability:** Creating and maintaining the conditions under which humans and nature can exist in productive harmony to support present and future generations. (Source: Environmental Protection Agency, Learn About Sustainability)

**Synthetic Rubber:** any of various synthetic materials, similar to natural rubber, made by polymerizing unsaturated hydrocarbons, such as isoprene and butadiene.

**Resin:** Resin is a sticky substance that oozes out of trees including fir and pine trees.



## Guayule Quiz

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Name:

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Directions: Answer all questions

- Which guayule product can be used for soil amendment?
  - Resin
  - Latex
  - Natural rubber
  - Bagasse
- Research has shown that guayule resin might repel what bug?
  - Honeybees
  - Lady bugs
  - Cockroaches
  - Wasps
- Guayule resin contains many different chemicals.
  - TRUE
  - FALSE
- Guayule grows well of the northern parts of the United States.
  - TRUE
  - FALSE
- Which of these products of guayule is a milky liquid that is accumulated in the cytoplasm?
  - Resin
  - Latex
  - Natural rubber
  - Bagasse
- Which of the following products are derived from guayule? (Circle all correct answers)
  - Tires
  - Surf suit
  - Medical devices
  - Coffee
  - Wood preservative
  - Soap



## Answer Key for Guayule Quiz

1. Which guayule product can be used as a soil amendment?  
**d. Bagasse** (video: 06:16)
2. Research has shown that guayule resin might repel what bug?  
**c. Cockroaches** (video: 09:45)
3. Guayule resin contains many different chemicals.  
**TRUE** (video: 04:39)
4. Guayule grows well of the northern parts of the United States.  
**FALSE** (video 00:44) – Guayule grows in hot, arid climates.
5. Which of these products of guayule is a milky liquid that is accumulated in the cytoplasm?  
**b. Latex** (video 01:44)
6. Which of the following products are derived from guayule?  
**tires, surf suit, medical devices, wood preservative** (video: 07:04)



## STANDARDS DETAIL:

### **AFNR Career Ready Practices**

CRP.02: Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.

CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.

CRP.02.02. Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.

CRP.04: Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods.

CRP.07: Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies.

CRP.08: Utilize critical thinking to make sense of problems and persevere in solving them.

CS.06. Analyze the interaction among AFNR systems in the production, S processing and management of food, fiber and fuel and the sustainable use of natural resources.

### **FFA Precept**

FFA.PL-A. Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand.

FFA.PL-E. Awareness: Understand personal vision, mission and goals.

FFA.PL-F. Continuous Improvement: Accept responsibility for learning and personal growth.

FFA.PG-J. Mental Growth: Embrace cognitive and intellectual development relative to reasoning, thinking, and coping.

FFA.CS-M. Communication: Effectively interact with others in personal and professional settings.

FFA.CS-N. Decision Making: Analyze a situation and execute an appropriate course of action.

FFA.CS-O. Flexibility/Adaptability: Be flexible in various situations and adapt to change.

### **NGSS**

HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

E S S2.D: Weather and Climate

E T S1.B: Developing Possible Solutions



## AUTHOR BIOGRAPHY

Oluwatobi (Tobi) Omotayo was born and raised in Lagos Nigeria. He is a graduate student in Agricultural Economics & Agricultural Business Department at New Mexico State University. His undergraduate degree is from the Federal University of Agriculture, Abeokuta, Nigeria where he studied Agricultural Economics. He now works with Dr. Frannie Miller and participates in the System Performance and Sustainability component of the Sustainable Bioeconomy for Arid Regions (SBAR) project. He also is assisting with extension, curriculum development, and youth outreach activities as part of SBAR. Tobi's goal is to build competences with a synergy of agriculture, data analytics and public policy so that he will be able to advocate for policies that will foster development in Africa and other emerging economies.

## ACKNOWLEDGMENTS

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